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The Editor's Page

FOR the greater convenience of users of the Abstract and Bibliography section of this magazine it will hereafter be headed Abstracts, and all subjects will be arranged alphabetically under their proper classifications. Originally the Bibliography section was designed to carry references by subject only; having few of these it became customary to run short abstracts under that heading, thus obliging the reader to look in two places for possible references on any subject. The new arrangement eliminates this.

The Interpretation of Scientific Findings

THE report of the Textile Foundation study on The Action of Sodium Hydroxide on Cellulose, by Bancroft and Calkin, the first installment of which appears in this number and will be concluded next month, treats of fundamentals of the causes and effects of mercerization. It will explode some previous theories of scientists, including the claim that the formation of certain chemical compounds is the cause of mercerization, and will point the way to uncertain points needing further investigation and data.

The report is necessarily of such a highly technical character as to be clearly understood by only the most advanced chemists. The purpose of this study was described in non-technical language in Vol. III, No. 9, pp. 461–62. It is the intention of the Editors to explain and interpret the results of this, and other published fundamental studies, in as non-technical language as possible. It must be understood, however, that there are companies within and outside of the textile industry which retain men of scientific training for the specific purpose of providing them with prompt, first-hand information of the possible practical application of such fundamental work. As new basic textile knowledge expands the services of such interpreters will be a valuable asset to all progressive concerns.

The Action of Sodium Hydroxide on Cellulose

Part 1, Section 1.—Determination of Sodium Hydroxide taken up from Solution; Change-in-Titer Method; Compound Formation vs. Adsorption

By WILDER D. BANCROFT[1] and JOHN B. CALKIN[2]

MERCER found (1844–1851) that when he treated cotton cellulose with caustic soda, he obtained certain desirable properties. The mercerization process has been the subject of a large number of scientific investigations. These investigations may be divided broadly into two interrelated problems: the cause of the mercerization and the nature of the product.

Mercer assumed that the phenomena of the process were due to the formation of a chemical combination between cellulose and sodium hydroxide. A large amount of data has been obtained by different methods. The investigators have interpreted their data in two different ways: i.e., chemical combination or adsorption.

In studying the problem it has become increasingly evident that any theory which aims to explain the mercerization process must take cognizance of the swelling which the cellulose undergoes. It appears from the literature that "mercerization" can be brought about by chemical agents other than sodium hydroxide. As far as we have been able to find out, these "mercerization" agents are used in aqueous solution and do not produce the desired effect unless the concentration is sufficient to cause proper swelling. We propose to discuss the swelling and its bearing on the plasticity of the fibers at more length in a future communication.

There is another fact in connection with mercerization by sodium hydroxide which should not be overlooked, i.e., that if the cotton is put under tension the product obtained shows a lower adsorption than it would if it were treated under the same conditions without tension, and that the product obtained under tension has an increased luster.

There are certain analogous properties between mercerized cotton and paper-making fibres which have been subjected to mechanical maceration in the presence of water. It should be pointed out that sufficient data are not at hand to press the analogy too far. It is proposed to discuss this more fully in a future paper.

In order to present a better picture of the various aspects of the problem it has been deemed advisable to chart the results of experimental

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[2] Fellow, The Textile Foundation.

TABLE I

Investigator	Type of cellulose	Amount of cellulose	Amount of solution added to cellulose	Amount of solution titrated	Time	Temperature
Vieweg[2]	Cotton wool	3 g.	150 cc.	50 cc.	1 hr. shaking 2 hrs. standing	Room
Miller[24]	Cotton	21.35 g.	500 cc.		1 hr. shaking	25° C.
Leighton[4]	Purified surgical cotton	1.0–1.2 g.	100 cc.	50 cc. dil. to 1 l. and used 50 cc.	3 hrs.	Room
Joyner[25]		1 g.	Weighed 10 cc. vol.	Def. wt.	1½ hrs.	Room
König[21] and Dehnert[22]	Purified cotton not bleached, dried over H_2SO_4 before using	1–1.5 g.	200 cc.	50 cc.	2 hrs. shaking	20° C.
Heuser and Niethammer[3]	Cotton flock dried at 104° C.	4 g.	50 cc.	5 cc.	1 hr. shaking 2 hrs. standing	20° C.
Heuser and Bartunek[20]	Cotton dried in vacuo at 100° C.	4 g.	50 cc.	Pressed out soln. 10 cc. diluted to 250 or 500 cc. and titrated 25 cc.	4 hrs.	
D'Ans and Jäger[23]	Cotton wadding and pulp partially dried	4 g. (dry basis)	80 cc.		4 hrs. with frequent shaking	Various
Lottermoser and Hönsch[12]	Purified raw cotton of known moisture content	3 g. (air dry basis)	100 cc.	Aliquot part	4 hrs. and 24 hrs.	
Neale[14]	Purified air dry cotton of known moisture content	2 g. (dry basis)	30 cc.	10 cc.		18–20° C.
Bancroft and Calkin	Purified absorbent cotton of known moisture content	2 g.	30–40 g.	8–12 g.	24 hrs. with frequent shaking	Room (23–25° C.)

work. In some cases topics have been only partially surveyed. They are included, however, to show the aspects of the problem. This chart is rather bulky and unhandy in its present state. A plan has been worked out whereby this chart can be split into small sections, but as there is considerable work involved in this plan and as the experimental work is still incomplete, it has been deemed inadvisable to put out the chart in its present form.

Considerable work on the mercerization problem has been done by x-ray methods. No reference to the x-ray literature is made in this paper. We shall discuss this phase of the problem in another communication.

Methods of Determining the Amount of Sodium Hydroxide Taken up From Solution

Gladstone[1] was the first to attempt to make a study to determine the amount of caustic soda taken up by cotton. He treated cotton with various concentrations of sodium hydroxide, and then washed the samples in cold absolute or hot alcohol of specific gravity 0.825. He concluded that the compound $(C_6H_{10}O_5)_2.NaOH$ was formed. At that time the phase rule was unknown and Gladstone's experimental method was permissible, but we now know that Gladstone's method is not a proof of compound formation. Furthermore, the use of alcohol simply introduces another variable. Washing with alcohol may be considered as a method of determining how much sodium hydroxide is retained if the sample is pressed out and subsequently washed with alcohol. Viewed in this light, it is not a method for determining the amount that cellulose will take up from aqueous solutions. Other investigators have used this method for the same purpose that Gladstone used it. Their work will be treated subsequently in its proper place. The work of Gladstone is merely discussed at this point because of its historical significance.

In 1907 Vieweg[2] introduced a new method to determine the amount of sodium hydroxide taken up. He placed a known weight of cotton and a known volume of solution in a flask. The solution was left in contact with the cotton for a definite period of time. From the change between the initial and final concentration he calculated what he considered to be the total amount of sodium hydroxide taken up. A number of investigators have used this method. A summary of the experimental details is given in Table I. The error involved in using different ratios of cellulose and solution has been investigated by Heuser and Niethammer,[3] and their results are shown in Table II.

TABLE II

Amount of cellulose used in g.	*Total amount of solution in cc.*	*Amount for determination in cc.*	*Per cent error*
1	50	5	15.4
2	50	5	7.71
3	50	5	5.13
4	50	5	3.85
4	40	5	3.07

Leighton[4] pointed out that "Vieweg's whole method of experimenting is unsound. It is customary to determine the amount of adsorption from the change in concentration; but this method rests on the assumption that no water is taken up by the solid phase; it becomes inaccurate the moment this assumption fails to hold. This is easy to see if we consider an extreme case. Suppose that cotton adsorbs water and caustic soda from a given solution in the same ratio that they occur in the solution. By hypothesis there will be no change in titer and consequently apparently no adsorption of the caustic soda even though all the caustic soda may actually have been adsorbed. While this extreme case may not occur often, we do know that cotton will take up a large amount of water and this fact was overlooked by Vieweg."

Leighton then attempted to determine the total amount taken up by removing the excess solution by centrifuging. Coward and Spencer[5] studied the performance of a specially built centrifuge, and concluded from studies on glass wool and cotton with various solutions, that they were able, in 7.5 minutes with a force equal to about 2230 times that of gravity, to remove all but about 5 or 10% of excess solution. Their results for the amounts of water and sodium hydroxide taken up were published subsequently.[6]

Beadle and Stevens[7] used artificial silk and removed excess solution by blotting the small hanks of artificial silk. Neale[8, 9] and Pfeffer[10] have used the blotting method for cellophane.

Part Played by Water in Calculating Amount of NaOH Taken up by Cellulose

It has been pointed out in the preceding section that many investigators have used the Vieweg change-in-titer method to calculate, what they believed to be, the total amount of sodium hydroxide taken up by cellulose. Leighton[4] was the first to point out the inherent error of the Vieweg method for determining the total amount taken up. This error is caused by the fact that the cellulose takes up water in addition to caustic. Other investigators have shown that water is taken up with the sodium hydroxide,[6, 7, 8, 10] the amount going through a maximum. The latter were determined from the total amount taken up by subsequently centrifuging or blotting the samples.

In order to try to check on the water taken up, using the change-in-titer method, we used sodium chloride with the sodium hydroxide. A known weight of NaOH-NaCl solution was placed in contact with cotton and the change of initial and final titer of both NaOH and NaCl determined. If no NaCl is taken up the weight of end solution can be calculated by the equation

$$\text{wt. end soln.} = \frac{\text{Total g. NaCl initially in soln.}}{\text{wt. NaCl/g. end soln.}}$$

In calculating the results after making due allowance for the moisture content of the cellulose (both in its effect on the weight of cellulose and dilution of the solution), it was found that whereas the initial solution weighed 47.7526 g. (not including 0.1279 g. water from the cellulose), the

end solution (calculated from the change in titer of the sodium chloride and on the assumption that no sodium chloride was taken up by the cellulose) weighed 48.1400 g. (including 0.1279 g. water from the cellulose). This discrepancy may be explained in the following ways: (1) Experimental error. (2) Dissolving some of the cotton. (3) Slight amount of NaCl taken up by the cotton.

The most plausible explanation appeared to be the last one. The cotton should not dissolve appreciably. The volumetric determination of chloride is in error by about 0.3%.[11] In order to determine the amount of NaCl taken up, cotton was placed in NaCl and a change-in-titer amount taken up (at 5.20 (wt.)% NaCl after 48 hours) of 0.00839 g. NaCl/10 g. cellulose was obtained when allowing for the dilution effect of the water in the cellulose, and 0.0118 g. NaCl/10 g. cellulose when neglecting the dilution effect (calculations based on bone-dry cellulose in both cases). Lottermoser and Hönsch[12] report 0.027 g. NaCl taken up per 10 g. cotton at an end concentration of 5.696 g. NaCl per 100 cc. solution after standing 30 hours; and 0.011 g. NaCl taken up per 10 g. cotton at an end concentration of 5.746 g. NaCl per 100 cc. solution after standing 120 hours.

The following table is calculated from the data of the NaOH-NaCl experiment:

TABLE III

Constituents/gram of solution

		End soln.	
	Initial soln.	*By NaCl*	*By titration*
NaCl	0.0481		0.0477
NaOH	0.0586	0.0581	0.0568
H_2O	0.8933		0.8955 *

* Cellulose contained H_2O.

What those using the Vieweg change-in-titer method are measuring is the amount of caustic taken up by a unit weight of cotton calculated from the change in titer of initial and final solution on the assumption that the water in the supernatant liquor is constant. Some investigators have realized the fallacy of the assumption. Those using centrifuging, or blotting, are trying to measure the absolute amount of caustic taken up per unit weight of sample.

The difference between the two can be readily seen from the following derivation: Let

G = wt. solvent in caustic soln. at start;
X_0 = mols caustic/g. solvent in outside soln. at start;
X = mols caustic/g. solvent in outside soln. at end;
A = mols caustic taken up by sample;
B = wt. solvent taken up by sample.

Writing an NaOH balance we obtain:

NaOH initially = NaOH taken up by solid phase + NaOH in liquid phase at end

Substituting the above symbols, we obtain:

$$NaOH = GX_0 = A + X(G - B) \quad (1)$$

or

$$GX_0 = A + XG - XB \quad (2)$$

which gives

$$G(X_0 - X) + XB = A \quad (3)$$

By taking s = mols of cellulose in sample, we obtain

$$\frac{G(X_0 - X)}{s} + \frac{XB}{s} = \frac{A}{s} \quad (4)$$

The final values for the change-in-titer method (basis 1 mol of cellulose = 162 g.) are given by $G(X_0 - X)/s$ and neglect the correction term XB/s. This correction term, XB/s, is equivalent to that amount of caustic which is taken up by the cellulose and which is unaccounted for by the Vieweg method of calculation, as the latter postulates that G is the weight of solvent at the end, instead of the actual amount, G — B. The total amount taken up is actually A/s which, as can be seen, takes care of the correction term XB/s.

Investigators who have studied the system cellulose-sodium hydroxide-water-alcohol by the change-in-titer method have found that, with increasing addition of alcohol, the value for the amount of caustic taken up at a given concentration increases. In order to obtain an idea of how much solution was taken up by cellulose in contact with varying aqueous alcoholic mixtures small squares of washed cellophane were placed in different water-alcohol solutions. The air-dry cellophane was previously tested and found to have no porosity as measured by the Gurley densometer test.[13] Because of this fact it was felt that the surface-adhering excess solution could be removed by simply blotting off the sample, thus having the sample substantially free from any excess solution and thereby providing a ready means of measuring the absolute amount taken up by the sample. After 24 hours the squares were taken out of the solutions, the samples blotted off, weighed and then dried. The calculated data are given in the following table:

TABLE IV

Solution	*Total swollen wt. per 162 g. cellophane*
H_2O	352
50 — 50 H_2O — 95% C_2H_5OH	275
95% C_2H_5OH	184
C_2H_5OH (abs.)	179
Air dry sample	179

An experiment carried out by the Vieweg change-in-titer method for sodium hydroxide in 95% alcohol solution gave a Vieweg titration value of 1.022 equivs./162 g. cellulose at an outside concentration of 2.38 mols/1000 g. of solvent. The value for the same cotton in water solution at

this concentration was about 0.15 equiv. per 162 g. cellulose. There are three facts which should be borne in mind in connection with the high value in alcohol solutions: (1) The lower solubility of caustic in alcohol should increase the amount taken up, because the lower solubility shows a decreased affinity of alcohol for sodium hydroxide as compared with water for sodium hydroxide; (2) the value for aqueous solutions is based on the assumption, which has been shown to be erroneous, that the solvent in the liquid phase is constant; (3) as more alcohol is added the value determined is nearer the true absolute amount taken up per unit weight of sample for that solution, and in absolute alcohol there is good indication that the value is the absolute amount taken up. For this case, namely, dry cellulose in absolute alcoholic sodium hydroxide solution, the amount taken up, as determined by centrifuging off all excess solution, should agree with the value determined by the change-in-titer method.

Experimental Determinations by Change-in-Titer Method

Before this work was started it was realized that the change-in-titer method did not give the absolute amount taken up. However, as this had been pointed out before, apparently to no purpose, and as it was the intention to bring out certain considerations of the system cellulose-sodium hydroxide-water it was decided to use this method.

The experiments were carried out on an accurate weight basis at room temperature (23–25° C.) using samples of about 2 g. of air dry cotton of known moisture content (allowance being made in the calculations for the dilution effect of the water and for the bone dry weight of the cotton) and about 35 g. of caustic solution (except in certain dilution experiments where amounts of solution down to about 10 g. were used for the first treatment*). About 5–10 g. of initial solution, depending on the concentration, were titrated with 0.1N HCl. After 24 hours an aliquot part of the supernatant solution in contact with the cotton was drawn off, weighed

TABLE V

Change-in-titer Method—Native Cotton—Concentration Series

Molality	*Mols NaOH taken up per 162 g. cotton*
0.79	0.053
0.80	0.061
0.98	0.066
1.87	0.112
2.56	0.171
3.30	0.300
5.07	0.495
5.11	0.512
5.70	0.497
5.81	0.460
7.54	0.487
7.84	0.530

* Neale has shown [14] that as small an amount of solution as 10 g. has no effect on the value up to 5 g./100 g. of solution, but he did not run any experiments at higher concentrations.

and titrated as for the initial solution. Dilution series were run by adding a known weight of water to samples which had stood for 24 hours. The samples were then allowed to stand another 24 hours before being analyzed.

The data for native cotton with increasing concentration are given in Table V. Three dilution series from various concentrations are given in Tables VI–VIII inc. The data are also shown in Fig. 1.

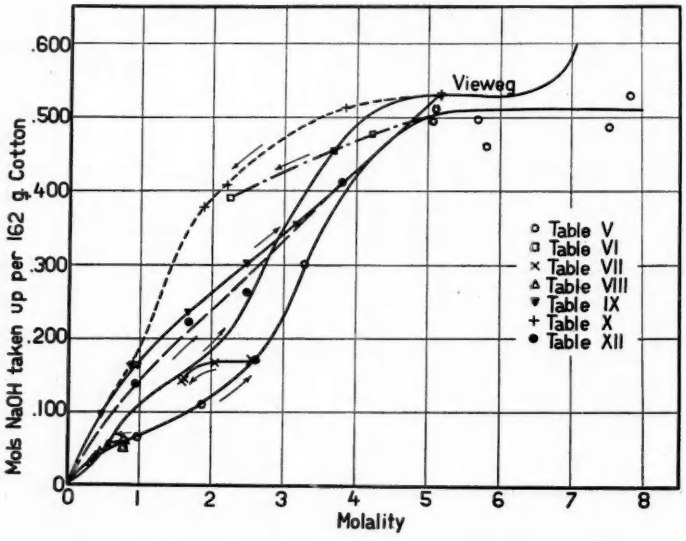


FIG. 1. Sodium Hydroxide taken up by Change-in-Titer Method.

Some of the native cotton was pretreated loose in 5 molal caustic for 24 hours. The cotton was then washed with water until caustic free and air dried. The data for this pretreated cotton with increasing concentration are given in Table IX. The data for a series diluted from 5.2 molal are given in Table X. These data are plotted in Fig. 1.

TABLE VI

Change-in-titer Method—Native Cotton—Dilution Series

	Molality	*Mols NaOH taken up per 162 g. cotton*
Diluted from	5.07	0.495
	5.11	0.512
Dilution values	4.23	0.478
	3.68	0.454
	2.25	0.391

TABLE VII

Change-in-titer Method—Native Cotton—Dilution Series

	Molality	*Mols NaOH taken up per 162 g. cotton*
Diluted from	2.56	0.171
Dilution values	2.05	0.168
	1.63	0.143
	1.60	0.142

TABLE VIII

Change-in-titer Method—Native Cotton—Dilution Series

	Molality	*Mols NaOH taken up per 162 g. cotton*
Diluted from	0.80	0.061
	0.79	0.053
Dilution values	0.56	0.056
	0.46	0.046
	0.40	0.043
	0.36	0.039
	0.31	0.031

TABLE IX

Change-in-titer Method—Pretreated Cotton—Concentration Series

Molality	*Mols NaOH taken up per 162 g. cotton*
0.48	0.098
0.88	0.162
0.98	0.163
1.68	0.236
2.50	0.301
3.18	0.355
5.19	0.531
5.20	0.531

TABLE X

Change-in-titer Method—Pretreated Cotton—Dilution Series

	Molality	*Mols NaOH taken up per 162 g. cotton*
Diluted from	5.20	0.531
	5.19	0.531
Dilution values	3.85	0.514
	2.20	0.409
	1.88	0.377
	0.93	0.167

As this cotton for the dilution series had been treated twice with caustic some native cotton was pretreated in 5.5 molal caustic for 24 hours, the cotton washed with water until caustic free and air dried, and then again pretreated, washed and dried as before. Data for this sample with increasing concentration are given in Table XI.

TABLE XI

Change-in-titer Method—Double caustic pretreated, 5.5 molal

Molality	*Mols NaOH taken up per 162 g. cotton*
1.72	0.227
3.37	0.367

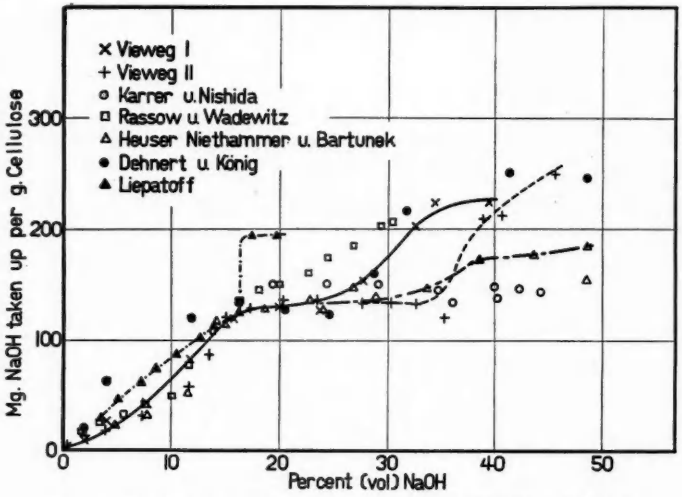


FIG. 2. Sodium Hydroxide taken up by Change-in-Titer Method.

In order to determine the effect of drying by heat on the amount taken up by pretreated cotton, samples were heated at 105° C. for 24 hours. The data are given in Table XII and in Fig. 1.

TABLE XII

Change-in-titer Method—Heating pretreated cotton 24 hours at 105° C.

Molality	*Mols NaOH taken up per 162 g. cotton*
0.95	0.138
1.68	0.222
2.50	0.263
3.82	0.411

(Change in weight of cotton negligible)

The effect of a shorter time at low concentration is given in Table XIII.

TABLE XIII

Change-in-titer Method—Native Cotton—3 hours standing

Molality	*Mols NaOH taken up per 162 g. cotton*
2.33	0.146
2.33	0.155

The data from the tables are shown graphically in Fig. 1. Vieweg's data have been recalculated and are plotted for comparison. The arrows show the course of the curves, whether determined for increasing concentration (concentration series) or for decreasing concentration (dilution series).

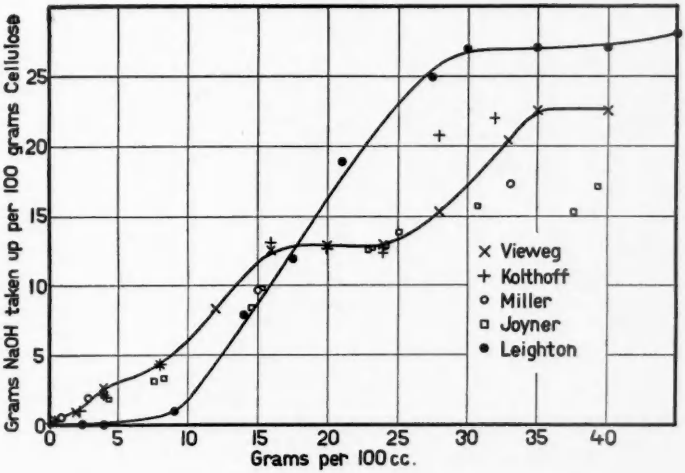


FIG. 3. Sodium Hydroxide taken up by Change-in-Titer Method.

Experimental Determinations on the Total Amount taken up, and Calculated Change-in-Titer Values

Several attempts have been made in the past to determine the total amount of sodium hydroxide and of water taken up. These have been made either by centrifuging cotton or by blotting cellophane. From these data and the algebraic derivation given previously it is possible to calculate the change-in-titer values. All the available data are given in Tables XIV to XXI and Figs. 4 to 9. Their significance will be discussed subsequently.

Compound Formation vs. Adsorption

One of the problems involved in the action of sodium hydroxide on cellulose has been whether the action results in the formation of definite compounds in mass or whether it is one of adsorption. It has been pointed out already that washing with alcohol is not a criterion of compound formation. Vieweg,[2, 15] as previously described, placed cellulose in contact with sodium hydroxide solutions and, from the change in titer, calculated

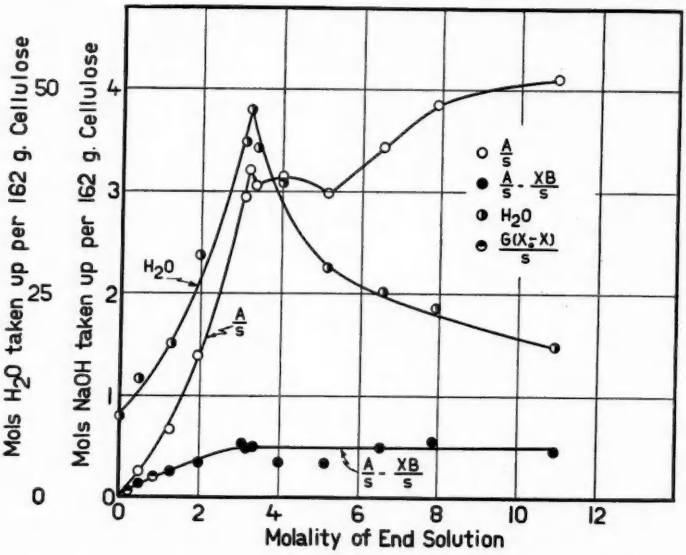


FIG. 4. Sodium Hydroxide and Water taken up by Cellophane at 25° C. (Neale's data).

what he believed to be the total amount taken up. He obtained a portion of his curve corresponding to the constant composition 0.5 mol NaOH to one mol (162 g.) $C_6H_{10}O_5$ and concluded that the compound $(C_6H_{10}O_5)_2$.NaOH is formed. Leighton[4] pointed out that Vieweg's curve, as a criterion for compound formation, was theoretically impossible, as according to the phase rule a portion of the curve should be perpendicular to the concentration axis for compound formation in mass: "If we have compounds . . . , we must have two phases along the other curves; the concentrations of these solutions should remain constant. . . ."

Notwithstanding the fact that the subject of compound formation is adequately treated elsewhere,[16, 17] it is felt that a discussion of the application of the phase rule to the problem of the taking up of sodium hydroxide by cellulose will not be out of place. The numerous attempts to make constant composition a criterion of compound formation in mass necessitate a clearing up of this matter. Consider three different systems

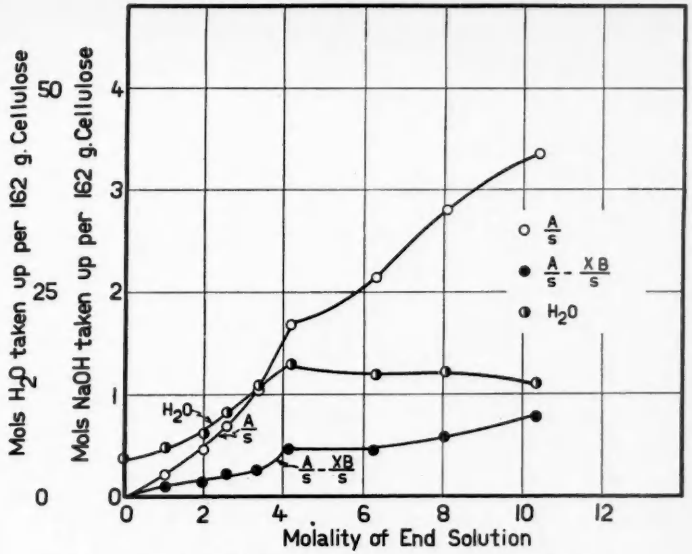

Mols H_2O taken up per 162 g. Cellulose
Mols NaOH taken up per 162 g. Cellulose
Molality of End Solution
$\frac{A}{s}$
$\frac{A}{s} - \frac{XB}{s}$
H_2O

FIG. 5. Sodium Hydroxide and Water taken up by Cotton (Coward and Spencer's data).

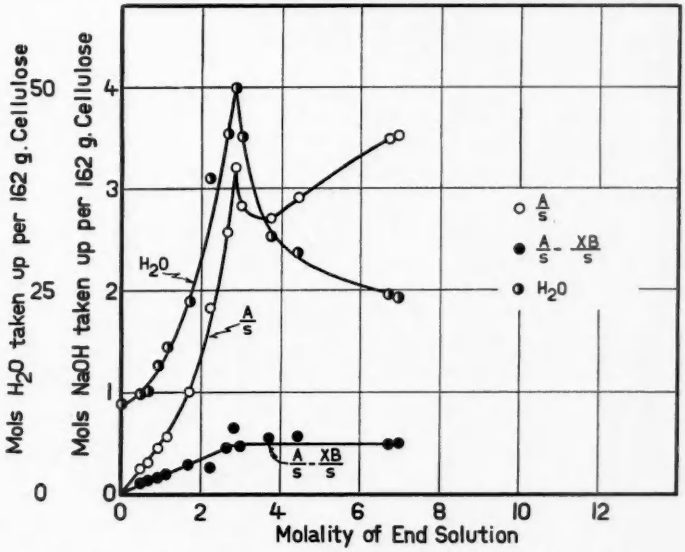
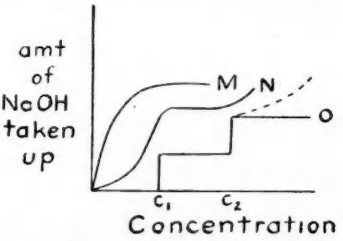

Mols H_2O taken up per 162 g. Cellulose
Mols NaOH taken up per 162 g. Cellulose
Molality of End Solution
$\frac{A}{s}$
$\frac{A}{s} - \frac{XB}{s}$
H_2O

FIG. 6. Sodium Hydroxide and Water taken up by Cellophane at 25° C. (Pfeffer's data).

of solid-sodium hydroxide-water; the solid in each case being a different substance only negligibly soluble in sodium hydroxide-water. Suppose the curves M, N and O, as shown in the figure, result. Along the vertical



portion of the curve O at c_1 there are four phases (solid, its mono-compound, sodium hydroxide solution and vapor), three components (solid, sodium hydroxide and water) and constant temperature. Applying the phase rule $F = C - P + 2$ we see that there is no degree of freedom. Consequently the concentration remains constant. At the end of this vertical line all the solid has been converted into the mono-compound. There are then only three phases present (mono-compound, sodium hydroxide solution and vapor) and the concentration increases until at the second vertical, at c_2,

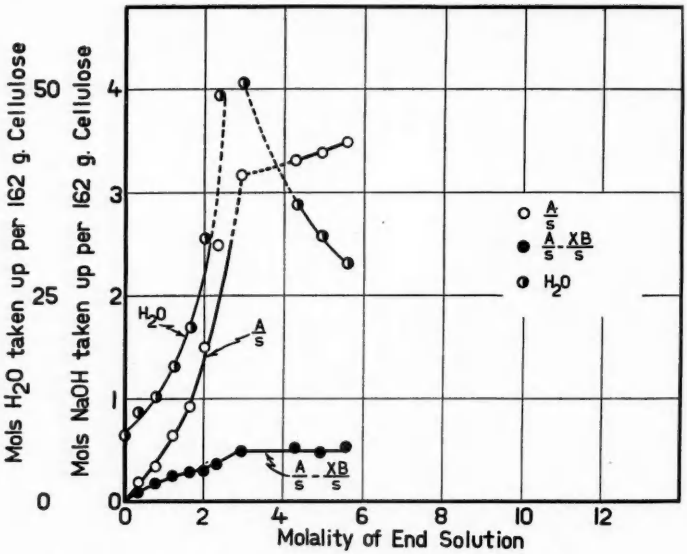


FIG. 7. Sodium Hydroxide and Water taken up by Viscose Rayon 1 at 25° C.

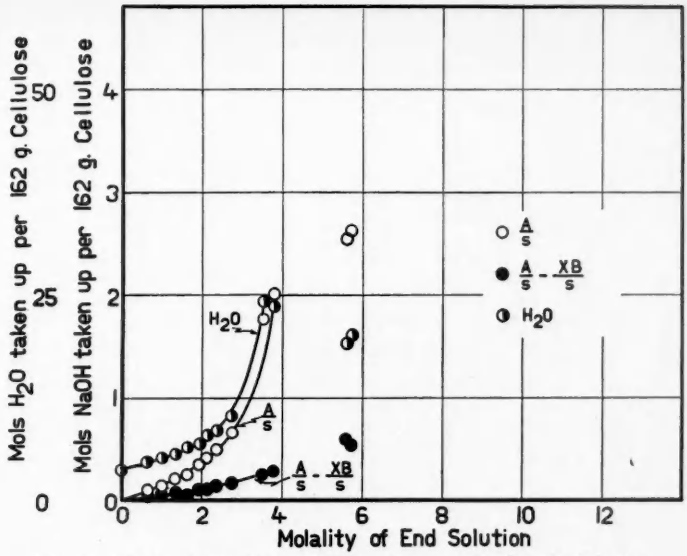

Mols H_2O taken up per 162 g. Cellulose
Mols NaOH taken up per 162 g. Cellulose
Molality of End Solution
H_2O
$\frac{A}{s}$
$\frac{A}{s} - \frac{XB}{s}$

FIG. 8. Sodium Hydroxide and Water taken up by Standard Cotton at 25° C.

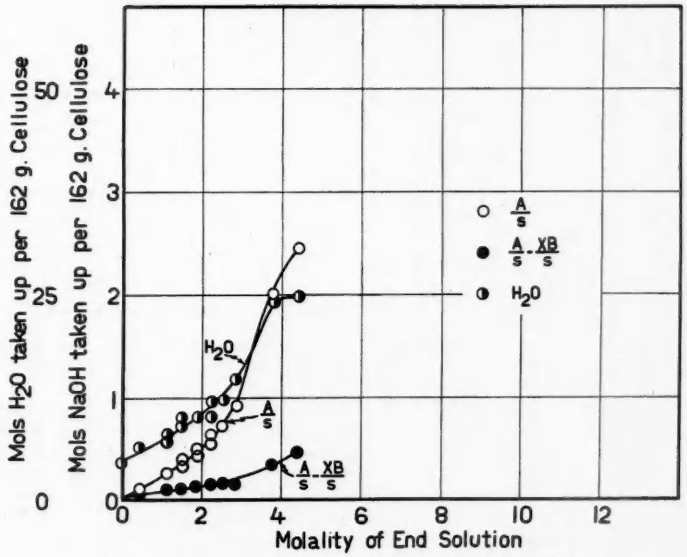

Mols H_2O taken up per 162 g. Cellulose
Mols NaOH taken up per 162 g. Cellulose
Molality of End Solution
H_2O
$\frac{A}{s}$
$\frac{A}{s} - \frac{XB}{s}$

FIG. 9. Sodium Hydroxide and Water taken up by Standard Cotton pretreated with 2.9-Molal (10.4%) Sodium Hydroxide.

the di-compound begins to form. Along this vertical the solid phases are the mono-compound and the di-compound. If at the end of the second vertical we have adsorption of the NaOH by the compound, we have the broken line,[18] otherwise the curve will continue along the unbroken (solid) line. Curve O proves that definite compounds of the composition represented by the *end* of the vertical line are formed in mass. As cellulose does *not* give such a curve we know *definitely* that there is no compound formed in mass.

TABLE XIV

Sodium Hydroxide and Water Taken Up by Cellophane at 25° C.

Blotting Method

(Data from Neale, *J. T. I.* 20, 373 T (1929))

Molality of End Solution Mols NaOH/ 1000 g. H_2O	Total NaOH taken up $\left(\frac{A}{s}\right)$ Mols NaOH/162 g. Cellulose	Total Water taken up Mols H_2O/162 g. Cellulose	Change-in-titer Amount taken up $\left(\frac{A}{s} - \frac{XB}{s}\right)$ Mols NaOH/162 g. Cellulose
0.0	0.0	10.05	0.0
0.482	0.265	14.7	0.137
1.215	0.672	18.95	0.258
1.97	1.412	29.7	0.358
3.09	2.955	43.7	0.525
3.175	3.21	47.6	0.490
3.345	3.085	42.85	0.504
4.00	3.15	38.6	0.370
5.16	2.985	28.25	0.360
6.55	3.435	25.15	0.470
7.89	3.843	23.2	0.555
10.92	4.105	18.7	0.425
12.45	4.30	16.5	0.601
13.52	4.555	15.4	0.805
14.16	4.75	16.45	0.561
16.18	5.455	16.7	0.593
17.7	5.615	16.05	0.500
18.5	5.90	16.15	0.520
19.6	6.19	15.95	0.565
21.2	6.865	16.05	0.745
23.3	7.28	15.55	0.760

The smooth curves, M and N, represent the adsorption of a series of compounds (not formed in mass), a continuous series of solid solutions or an adsorption. Coward and Spencer[6] have postulated a series of compounds $(C_6H_{10}O_5)_m.(NaOH)_n$, but their curve is a smooth adsorption curve. As far as we know no one has come out frankly for the adsorption of a series of compounds (not formed in mass). Neale's viewpoint[8] might be interpreted along this line of reasoning. He states: "a system consisting of cotton or other mass of cellulose immersed in a solution of caustic soda may be divided into 'gel' and liquid phases containing the following molecular species.

Cellulose or Gel Phase (1)	*Liquid Phase* (2)
Undissociated acid HA	
Ionised sodium salt $Na^+ A^-$	
Ionised sodium hydroxide $Na^+ OH^-$	$Na^+ OH^-$
Hydrogen ion H^+	
Water H_2O	H_2O''

Neale also refers to the cellulose as the "solid or gel phase." It is known in the case of metals that oxides and other compounds are adsorbed by the metal. "Blue powder is another case of adsorption in which the grains of zinc are coated with zinc oxide. A copper roof lasts practically indefinitely, not because the copper is not attacked, but because it is protected by the coating of basic carbonate. Aluminum and nickel are always coated with solid surface films. . . . Passive iron owes its peculiar properties to the adsorption and stabilization of the oxide FeO_3.''[16] There is a possibility that a phase rule study of the system glucose-sodium hydroxide-absolute alcohol might shed light on this point in the case of cellulose as it should be possible to determine whether or not a series of compounds are formed in mass in the system glucose-sodium hydroxide-absolute alcohol.

Table XV

Sodium Hydroxide and Water Taken Up by Cotton

Centrifuge Method

(Data from Coward and Spencer, *J. T. I.* 14, 32 T (1932))

Molality of End Solution Mols NaOH/ 1000 g. H_2O	Total NaOH taken up $\left(\frac{A}{s}\right)$ Mols NaOH/162 g. Cellulose	Total Water taken up Mols H_2O/162 g. Cellulose	Change-in-titer Amount taken up $\left(\frac{A}{s} - \frac{XB}{s}\right)$ Mols NaOH/162 g. Cellulose
0.0	0.0	4.71	0.0
1.041	0.226	6.11	0.111
1.996	0.45	7.98	0.163
2.59	0.702	10.45	0.214
3.375	1.061	13.56	0.237
4.16	1.685	16.24	0.469
6.29	2.154	15.0	0.456
8.06	2.815	15.26	0.598
10.36	3.359	13.79	0.789
15.99	4.57	12.44	0.991
23.8	6.279	11.97	1.154

If the smooth curves represent either a continuous series of solid solutions or adsorption, an x-ray determination might settle the question, providing changes in the structure of the cellulose itself from swelling do not interfere, as the crystal structure should vary if a solid solution is formed.

Various investigators have interpreted their curves as showing the formation of definite compounds, merely because they obtained a constant

composition. Vieweg[19] has even gone so far as to interpret the formation of $(C_6H_{10}O_5)_2.NaOH$ without bothering to draw curves. The constant composition may be the end of the adsorption curves. Bancroft[16] has discussed this point in relation to the adsorption of acetic acid by various charcoals: "That the adsorption does not change appreciably after a certain concentration has been reached in the solution seems to be shown conclusively in some experiments by Schmidt on the adsorption of acetic acid by charcoal. . . . In both these cases people who looked only at the last five or six figures might easily decide that a definite compound was formed, though it would have to be a different one in each case."

Heuser and Niethammer,[3] Heuser and Bartunek,[20] König and Dehnert,[21, 22] and D'Ans and Jäger,[23] working in the same way as Vieweg, obtained data similar to those of Vieweg and concluded therefrom, in spite of what Leighton had previously pointed out, that the compound $(C_6H_{10}O_5)_2.NaOH$ was formed in mass. Their data are shown graphically in Fig. 2 (cf. D'Ans & Jäger[23]).

Leighton,[4] Miller[24] and Joyner[25] believe the process one of adsorption. Their data together with others are shown in Fig. 3 (cf. Clibbens[27]). Lottermoser and Hönsch[12] concluded from their studies that the process corresponds neither to salt formation nor to an undisturbed pure adsorption. With regard to the point of undisturbed pure adsorption reference is called

Table XVI

Sodium Hydroxide and Water Taken Up by Cellophane at 25° C.

Blotting Method

(Data from Pfeffer, M. I. T. Thesis, 1932)

Molality of End Solution Mols NaOH/ 1000 g. H_2O	Total NaOH taken up $\left(\frac{A}{s}\right)$ Mols NaOH/162 g. Cellulose	Total Water taken up Mols H_2O/162 g. Cellulose	Change-in-titer Amount taken up $\left(\frac{A}{s}-\frac{XB}{s}\right)$ Mols NaOH/162 g. Cellulose
0.0	0.0	11.29	0.0
0.490	0.243	12.42	0.133
0.495	0.233	12.42	0.122
0.688	0.303	12.56	0.148
0.692	0.343	13.23	0.178
0.903	0.434	15.88	0.176
1.16	0.577	18.20	0.197
1.70	1.013	23.62	0.290
1.77	1.061	22.95	0.330
2.21	1.825	39.0	0.274
2.66	2.579	44.31	0.457
2.84	3.22	50.25	0.650
2.99	2.841	44.1	0.468
3.73	2.712	31.9	0.571
4.42	2.925	29.57	0.575
6.72	3.48	24.7	0.492
6.97	3.56	24.22	0.520

TABLE XVII

Sodium Hydroxide and Water Taken Up by Viscose Rayon 1 at 25° C.

Centrifuge-Blotting Method

Molality of End Solution Mols NaOH/ 1000 g. H_2O	Total NaOH taken up $\left(\frac{A}{s}\right)$ Mols NaOH/162 g. Cellulose	Total Water taken up Mols H_2O/162 g. Cellulose	Change-in-titer Amount taken up $\left(\frac{A}{s} - \frac{XB}{s}\right)$ Mols NaOH/162 g. Cellulose
0.0	0.0	8.05	0.0
0.383	0.192	10.85	0.121
0.381	0.188	10.95	0.113
0.805	0.370	12.91	0.183
0.808	0.381	12.91	0.193
1.236	0.608	16.22	0.247
1.247	0.618	16.48	0.254
1.670	0.924	21.2	0.286
1.672	0.922	21.02	0.289
2.005	1.505	32.9	0.317
2.01	1.466	31.47	0.328
2.33	2.485	50.0	0.387
2.34	2.44	49.15	0.370
2.935	3.19	51.0	0.500
2.935	3.17	50.8	0.481
4.30	3.32	36.2	0.520
4.32	3.24	34.9	0.526
4.90	3.44	33.07	0.523
5.01	3.35	31.75	0.488
5.60	3.49	29.1	0.560
5.58	3.51	29.3	0.565

TABLE XVIII

Sodium Hydroxide and Water Taken Up by Viscose Rayon 2 at 25° C.

Centrifuge-Blotting Method

Molality of End Solution Mols NaOH/ 1000 g. H_2O	Total NaOH taken up $\left(\frac{A}{s}\right)$ Mols NaOH/162 g. Cellulose	Total Water taken up Mols H_2O/162 g. Cellulose	Change-in-titer Amount taken up $\left(\frac{A}{s} - \frac{XB}{s}\right)$ Mols NaOH/162 g. Cellulose
0.0	0.0	7.89	0.0
0.424	0.202	10.26	0.123
0.876	0.407	12.49	0.210
1.613	0.791	18.0	0.268
1.619	0.802	18.2	0.271

to Fig. 1, which shows that a number of apparent equilibria are obtained with cotton, depending on the type of sample and on how a given concentration is obtained. Lottermoser and Hönsch [12] ran dilution and concentration series on native cotton and found that they did not coincide. They further found that above about 7–8% (vol. %) the 4 hour curves and the 24 hour curves did not correspond.

TABLE XIX

Sodium Hydroxide and Water Taken Up by Standard Cotton at 25° C.

Centrifuge-Blotting Method

Molality of End Solution Mols NaOH/ 1000 g. H_2O	Total NaOH taken up $\left(\frac{A}{s}\right)$ Mols NaOH/162 g. Cellulose	Total Water taken up Mols H_2O/162 g. Cellulose	Change-in-titer Amount taken up $\left(\frac{A}{s} - \frac{XB}{s}\right)$ Mols NaOH/162 g. Cellulose
0.0	0.0	3.75; 3.86	0.0
0.664	0.111	4.82	0.053
0.680	0.104	4.66	0.047
1.01	0.158	4.97	0.068
1.013	0.160	5.25	0.064
1.326	0.220	5.66	0.084
1.646	0.260	6.21	0.076
1.634	0.273	6.46	0.083
1.925	0.371	7.10	0.125
1.935	0.360	6.78	0.124
2.11	0.415	8.04	0.109
2.125	0.407	8.04	0.101
2.37	0.504	8.60	0.137
2.375	0.519	8.75	0.145
2.78	0.684	10.38	0.164
2.79	0.703	10.74	0.163
3.52	1.79	24.3	0.249
3.80	2.05	25.65	0.295
3.79	1.885	23.6	0.275
5.60	2.555	19.4	0.600
5.71	2.64	20.2	0.565

Blanco, in his summary of the literature on the action of alkalis on cellulose,[28] states: "of the chemical methods that of Vieweg appears to be more satisfactory. It has been carefully studied and modified by Heuser,[2] who found the smallest per cent error in titration when using 1 part of cellulose and 10 parts of alkali by weight." It is true that Heuser found the smallest titration error in the method, but the real point is that the Vieweg change-in-titer method is basically in error as a means of showing the absolute amount of alkali taken up by the cellulose from aqueous alkali solutions. Coward and Spencer [6] have calculated the amount of sodium hydroxide taken up by change in titer from total adsorption data by a complicated formula, but did not have sufficient data over the flat portion of the change-in-titer curve. They concluded "that there is no step in the curves corresponding with the formation of a definite compound such as

TABLE XX

Sodium Hydroxide and Water Taken Up by 2.9 M (10.4 per cent) Pretreated Cotton at 25° C.

Centrifuge-Blotting Method

Molality of End Solution Mols NaOH/ 1000 g. H_2O	Total NaOH taken up $\left(\frac{A}{s}\right)$ Mols NaOH/162 g. Cellulose	Total Water taken up Mols H_2O/162 g. Cellulose	Change-in-titer Amount taken up $\left(\frac{A}{s} - \frac{XB}{s}\right)$ Mols NaOH/162 g. Cellulose
0.0	0.0	4.78; 4.78	0.0
0.443	0.111	6.50	0.059
0.446	0.121	6.74	0.067
1.125	0.278	8.18	0.112
1.128	0.257	7.35	0.106
1.499	0.412	10.17	0.137
1.509	0.371	9.24	0.120
1.908	0.451	9.44	0.127
1.908	0.504	10.32	0.149
2.22	0.576	10.32	0.164
2.22	0.655	12.15	0.169
2.52	0.727	12.18	0.174
2.53	0.731	12.45	0.164
2.875	0.927	14.79	0.162
3.795	2.012	24.15	0.363
3.68	1.929	23.5	0.372
4.405	2.44	24.85	0.470

TABLE XXI

Sodium Hydroxide and Water Taken Up by 5.44 M (17.86 per cent) Pretreated Cotton at 25° C.

Centrifuge-Blotting Method

Molality of End Solution Mols NaOH/ 1000 g. H_2O	Total NaOH taken up $\left(\frac{A}{s}\right)$ Mols NaOH/162 g. Cellulose	Total Water taken up Mols H_2O/162 g. Cellulose	Change-in-titer Amount taken up $\left(\frac{A}{s} - \frac{XB}{s}\right)$ Mols NaOH/162 g. Cellulose
0.0	0.0	6.34; 6.34	0.0
1.952	0.751	14.58	0.239
1.963	0.765	14.75	0.244
2.265	0.959	16.75	0.276
2.265	0.978	17.06	0.282

$2(C_6H_{10}O_5).NaOH$." Neale [3] has indicated how the change-in-titer values can be calculated, but did not carry out the calculations. Since the Coward and Spencer work more total adsorption data have been obtained. Using the relation previously deduced, a number of total adsorption data have been used to calculate the change-in-titer data and are shown graphically in Figs. 4 to 9. It can only be hoped that from this further presentation of the matter that the "doubting Thomas" school, relying on the Vieweg method to prove the existence of $(C_6H_{10}O_5)_2.NaOH$ in mass, will be convinced of the fundamental factual error of their deductions.

(*To be concluded*)

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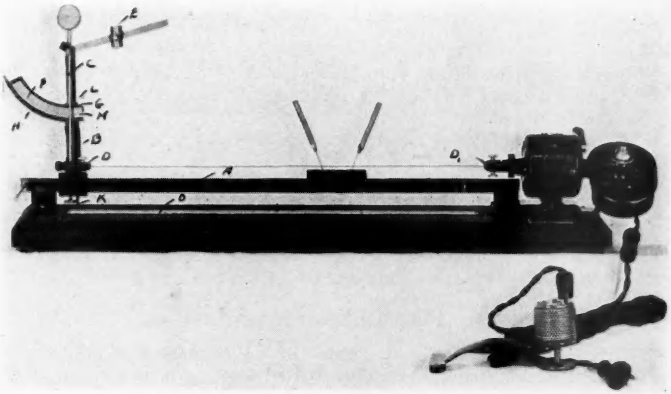
Twist and Twist Take-Up Tester*

IN determining the twist and twist take-up of yarns, especially those of high twist, such as silk and rayon crepe, tension throughout the test must be given careful consideration to obtain results that are uniform and repeatable. If the yarn is placed very taut between the clamps of the tester it may be stretched so that the turns per inch and the take-up, as recorded on the twist counter, would not give a true picture of the yarn. The same is true if the yarn is placed between the clamps too slack.

Twist take-up is the difference in length of yarn before and after testing expressed as a percentage based on the original length before twisting. After the twist has been removed from a yarn on a twist counter, the yarn should be allowed to extend to its original length for the proper reading and calculation of twist take-up.



Twist and Twist Take-up Tester

As a result of a series of conferences, held under the auspices of the Throwsters' Research Institute, and attended by technicians representing commercial and private laboratories making twist and twist take-up determinations of yarns, methods of sampling and making tests were standardized, but it was decided that, before uniformity of results could be obtained, an apparatus would have to be developed to overcome the question of tension. An improved tester, designed to meet this demand has been developed by the United States Testing Company, Inc., and the new device is available for attachment to standard twist testers.

* Abstract of article in *Rayon and Synthetic Yarn Journal*, Aug. (1933), P. 14, 15.

Test Method

Place one end of thread or yarn in clamp D1 and tighten. Place other end of thread or yarn in clamp D and, with locking bar H open, pull on thread until index pointer L is in line with starting mark M, and tighten clamp D. As the twist is removed from specimen, pendulum C will gradually swing to the left taking up the slack in the yarn. When all twist is removed from yarn a reading on take-up scale F at index pointer L is made, giving the take-up of the twisted thread or yarn in .05 inches.

The eccentric lever G operates locking bar H, making it possible to hold pendulum C in any position from the starting mark M to the six-inch mark on take-up scale.

The weight E is movable, thus affording means of obtaining increased tension for heavier types of yarns. A chart has been drawn up showing the recommended tensions for various weights and types of yarn.

Thumb screw J is for the purpose of setting clamps D and D1 any distance apart up to 20 inches as indicated by pointer K on scale O.

Recommended Tension Weights for Silk and Rayon Yarns

Silk

Single end and 2 thread	10 grams
3, 4 and 5 thread	20 grams
6 thread or over	30 grams

Based on 13–15 denier. For other sizes, use weight in proportion.

Rayon

50 and 75 denier	10 grams
100 and 150 denier	20 grams
Over 150 denier	30 grams

Zein: Possible Protein Source of Artificial Silk *

ZEIN, heretofore little known outside of the laboratory or the museum exhibit of interesting curiosities derived from corn, seems now ready to join the growing list of industry's low-priced raw materials, with possible applications in fields including plastics, filaments, films, finishes, sizing, and adhesives. A vegetable protein, it is extracted from corn-gluten, a by-product in the manufacture of corn starch, and forms a hard, colorless amorphous solid of horn-like character. Zein, when crude, contains corn oil and other impurities, but properly manufactured it is tasteless and odorless.

The properties of zein have been the subject of frequent investigation since it was first described in 1821, and its composition is probably better known than that of any other protein. Perhaps most important of its characteristics is its resemblance in certain respects to cellulose and cellulose derivatives. Like them, it softens slightly but does not dissolve in water.

* From *Industrial Bulletin* of Arthur D. Little, Inc.

It is insoluble in absolute alcohol, though it is readily soluble in less-concentrated alcohol solutions, such as 80% (by volume), and in many other solvents.

Likely applications of zein exist in many fields in which plastics and resins are used. Solutions of zein when evaporated to dryness leave a transparent continuous film capable of being dyed and filled, and of being plasticized, like cellulose derivatives, to overcome the natural brittleness of the film. Or, as zein is miscible with numerous cellulose derivatives, it may be used as a filler in sheets of molding compounds, apparently causing no impairment in strength when so used.

> *Filaments of zein have been made in the laboratory. These, unlike the common artificial silks, are of protein matter, and therefore more nearly approximate natural silk in chemical composition. At present, improvement must be made in the physical properties of zein fibres before they can be considered seriously for the manufacture of artificial silk. The possibilities are interesting to contemplate, however.*

The resistance of zein to water, its non-putrescence, non-inflammability, indicate its advantageous use for certain purposes as an adhesive, in sizing and coating paper and textiles, and in finishing leather or leather substitutes. On the other hand, since it dissolves in dilute caustic solution with the formation of sodium zeinate, zein may be used for a water-soluble, as well as for a spirit-soluble base. Its main applications will probably lie in the fields indicated, but recent experiments with zein as a reenforcing compounding material for rubber, as an example, indicate that, like all products ready for introduction on an industrial scale, it is likely to develop numerous applications at present unforeseen.

Abstracts

This section is compiled under the direction of the Committee on Abstracts and Bibliography: Prof. E. R. Schwarz, Chairman, Dr. W. E. Emley, Prof. Louis A. Olney and M. W. Weiss.

I. Fibres (Synthetic and Natural) and Fibre Analysis

Cellulose o-Chlorobenzyl Ethers: Formation. R. H. Ball and H. Hibbert. *Canadian J. Res.*, 1932, V. 7, 481–498.

Methods for the study of the specific effect of the factors involved in the preparation of cellulose o-chlorobenzyl ethers, and for the quantitative separation of the cellulose mono- and lower ethers from the higher cellulose ethers are described. (Copied from *J. T. I.*, Feb., 1933, P. A121.) (S)

Cellulose: Synthesis of (German). Dr. Kurt Roos. *Die Kunstseide*, April, 1933, P. 128–134.

The present status of the subject including a table comparing cotton cellulose with the synthetic cellulose, both in five forms. (S)

Chemical Wood Pulp for Rayon Manufacture: Controlling the Quality of. R. Palinert. *Papier*, 1933, V. 36, P. 449–52.

The importance of uniformity of quality of successive shipments of pulp received at a given viscose plant is emphasized. The methods for evaluating various properties of pulps, are briefly described. (Copied complete from *Chem. Abs.*, 1933, V. 27, P. 4074.) (W)

Cotton.: Histological Synthesis of. R. Haller. *Helv. Chim. Acta.*, V. 16, No. 3, 1933, P. 383–92.

The structure of cotton fibres was studied microscopically. The fibres were immersed in ethylenediamine-copper hydroxide solution which dissolved the binding substance from the fibre and exposed the fibrillary structure. (Copied complete from *Eastman Kodak Abs. Bull.*, Aug., 1933, P. 293.) (S)

Cotton: Influence of Period of Illumination on the Development of. N. Konstantinov. *Turkestan Plant Breed St., Nihi, Popular Sci. Ser.*, 1930, No. 10, 18 pp.

Experiments were carried out on perennial forms of *Gossypium peruvianum* and *Gossypium herbaceum*, the effect of varying length of day being observed. (Copied complete from *J. T. I.*, Jan., 1933, P. A10.) (S)

DEGUMMING NATURAL SILK IN THE PRESENCE OF ACETATE RAYON. Hanns Schmidt. *Monatschr. Textil-Ind.*, 1932, V. 47, P. 14–15.

Discussion of the known processes of H. Dreyfus (*Chem. Abs.*, V. 24, P. 4172) and I. G. Farbenindustrie A.-G. (*Chem. Abs.*, V. 25, P. 829). (Copied complete from *Chem. Abs.*, 1933, V. 27, P. 3828.) (W)

FLEECE ANALYSIS IN SHEEP. R. H. Burns. *Proc. 24th Annual Meeting of the Amer. Soc. Animal Production*, 1931, pp. 246–258 (1932).

Three micrometer measurements of thickness at three portions of 100 fibres gave a mean fineness closely corresponding to the weight-length ratio. The measurement of 100 fibres from each composite sample gave a mean fineness well within the selected limit of error. The variation between mean micrometer fineness of quadruplicate samples contiguous to a selected point on the body was negligible. The variation between average density of quadruplicate samples contiguous to a selected point on the body was significant, this being due more to errors of sampling and determination than to inherent differences. The variation between the average mean micrometer fineness and average densities of different areas of the body was significant. Composite samples of body areas and regions, made up by "quartering" or zoning the quadruplicate samples gave fineness and density figures which correspond closely with the results obtained by averaging the determinations from each quadruplicate sample within the body area or region. Micrometer means of fineness correspond closely with weight-length ratios of the same fibres. The coefficient was 0.973 ± 0.0013. The system of sampling adopted for any particular experiment would depend on the nature of the fleeces of the sheep under study and the objects of the experiment. (Copied complete from *J. T. I.*, Feb., 1933, P. A110.) (S)

GOSSYPIUM: GENETICS OF. S. C. Harland. *Bibl. Genet.*, 1932, V. 9, 107–182.

A very exhaustive review of the literature of cotton genetics up to date, including remarks on the taxonomy and cytology of the genus. The characters are taken in turn and an indication given of the results of work done on their inheritance. The article is furnished with a bibliography and an index. (Copied complete from *J. T. I.*, Jan., 1933, P. A9.) (S)

KEMP IN BLACKFACE SHEEP: A NOTE ON THE INHERITANCE OF. D. M. Bryant. *J. T. I.*, Aug., 1933, T309–T316.

The presence of kemp fibres in the wool of domesticated sheep is a matter of no little moment both to the breeder and to those concerned with the manufacture of woolen materials. To the breeder kemp is important since it adversely affects the price he obtains for his fleece, and to the manufacturer kemp is wholly objectionable in all but the coarsest fabrics, for no method of removing it is available except the laborious one of hand-picking. In most of the fine-wooled breeds, the occurrence of kemp fibres is comparatively rare; their occurrence is sufficiently frequent in some breeds, however, notably the Cheviot, to cause considerable wastage. In view of this, it was thought that investigations should be carried out to ascertain, if possible, the mode of its inheritance.

A method of analysing kempiness on a weight percentage basis in Blackface wool by selecting samples from a definite anatomical area on the living sheep is described.

From a Blackface flock survey of the content of kemp in the fleece on a percentage-by-weight basis, it is possible to state that this forms a satisfactory method of assessing a value for the presence of kemp in the fleece.

Analysis of samples from parental and filial generations enables the following conclusions to be drawn: Kempiness in the fleece is inherited; rams with fleeces containing less than 1% of kemp leave greater numbers of progeny which approximate this figure than do more kempy rams.

It should be readily possible to found and maintain a flock showing low kemp content provided such rams as show less than 1% of kemp were used and elimination of kempy sheep was carried out. (S)

MERINO WOOL: FIBRE GROWTH PHASES IN A SAMPLE OF AUSTRALIAN. J. E. Nicols. *J. T. I.*, Sept., 1933, P. T333–T340.

The wool follicle displays great flexibility in the manner of its response to conditions affecting its rate of activity, and maintains the continuity of its production of fibre material under wide changes of metabolism. In this sample the average rate of production per month (in terms of volume) in the second growth period was approximately two-thirds that during the first period while between the second and third phases a sudden acceleration to a rate over twice as great was manifested. In view of the fact that these changes in volume are not contributed to by thickness and length rate in the same proportion at each alteration in activity, it would seem desirable that the relative importance of the different responses should be considered in studies on factors influencing wool production. (Where medulla formation is included in fibre growth, the balance of cross-sectional area and length rate changes might be more grossly disturbed.)

It can be suggested that the discrimination between cases in which variations in metabolism are accommodated chiefly by alterations in thickness of fibre and those in which length growth rate is predominantly affected, would be of particular application in the selection of sheep for habitats where seasonal effects are frequent or usual.

References to investigations on the growth rate of wool are considered according to the particular dimensional attributes which have been studied.

Detailed analyses are recorded of an Australian Merino sample which shows two well-defined changes in character and quality along the staple.

At the times of these changes in character, the rate of elaboration of fibre substance altered greatly; in terms of mean volume per month, production in the second period was 27% less than in the first, and 109% greater in the third than in the second.

In these different levels of production, length-rate and thickness did not share in the same proportions at each "break."

The desirability is emphasized of considering both thickness change and altered rate of length increase, and of assessing the relative importance of their contributions to the expression of follicle activity in the form of volume of fibre substance. (S)

SILK: A NEW WILD. Guido Colombo. *Boll. ufficiale staz. sper. seta*, 1932, V. 2, P. 124–6.

The fibre of Caligula japonica called "wild Corean silk" has an average length of 6–7 cm. and a diameter of 75–80 μ. It gives the following data: Loss by degumming 4.4, ash 3.24% (CaO 39.61; MgO 18.54%). The degummed silk has: Humidity (at 140°) 11.34% on dry fibre, N 16.76, ash 0.18%; the fibroin contains S 0.3%. (Copied complete from *Chem. Abs.*, 1933, V. 27, P. 3614.) (W)

SILK SOAKING: EFFECT OF SALT ON BOIL-OFF. Ralph Hart. *Tex. Col.*, 1933, V. 55, P. 378–9; cf. *Chem. Abs.*, 1933, V. 27, P. 3339.

In addition, a method for calculating boilf-off and oil efficiency is outlined (Copied complete from *Chem. Abs.*, 1933, V. 27, P. 4085.) (W)

SODIUM CELLULOSE XANTHATE: PROPERTIES AND COMPOSITION OF. Heinrich Lotze. (German.) *Die Kunstseide*, June, 1933, P. 194–197.

The first of a series of seven articles dealing with the chemistry, colloidal chemistry, and physics of viscose. This particular section treats of the undecided composition of sodium-cellulose-xanthate and the by-products formed in the reaction with carbon disulfide. (S)

SPECIFIC GRAVITY: DETERMINATION OF. I. SPECIFIC GRAVITY OF ACETATE RAYON. P. M. Heertjes, W. Coltof and H. I. Waterman. *Rec. trav. chim.*, 1933, V. 52, P. 305–20.

The gases air, H_2 and He were used as the filling medium in determining the specific gravity of acetate rayon at temps. from 19° to 60°. With air, the apparent specific gravity is greatest, and falls with rising temperature; with H_2, it is smaller and falls somewhat with rising temperature; with He, it is lowest, and constant. These results are explained by the assumption that He is not adsorbed by the solid, but that air and H_2 are, with decreasing adsorption at increasing temps. With He, d. = 1.32. An adsorption of 0.06 mg. of air per g. of rayon is sufficient to explain the apparently high values for air. The method was checked with cryst. and powdered cane sugar, respectively, giving the values: Air: d. = 1.582, 1.585; H_2: d. = 1.584, 1.588; He: d = 1.585, 1.584. In a pycnometer with CCl_4 as liquid, for cryst. sugar, $d_4^{20} = 1.590$. (Copied complete from *Chem. Abs.*, 1933, V. 27, P. 3615.) (W)

WILD SILKS. II. ISOELECTRIC POINT OF LIQUID SILK. III. VISCOSITY OF FIBROIN SOL. Shozo Bito. *Bull. Sericult. Silk Ind.* (Japan) 1932, V. 5, No. 2, P. 3, 4; cf. *Chem. Abs.*, 1932, V. 26, P. 2059.

The isoelectric points of the liquid silk from the wild silkworms Antheraea pernyi and Dictyoploca japonica occur at pH 2.6 and 2.8–2.92, respectively.

III. Wild silk is more resistant to Loewe's reagent than is true silk, the order of increasing resistance to solution being: True silk, Kuriwata, Yamamai, tussah and Attacus cynthia. The viscosity of the fibroin sols decreases with increasing time and is represented by the equation $n = at^b$, where n is the viscosity, t the time in hours and a and b are constants. (Copied complete from *Chem. Abs.*, 1933, V. 27, P. 3614.) (W)

WOOL FIBRE AND ITS RELATION TO FINISHING: STRUCTURE OF THE. J. B. Speakman. *J. T. I.*, Aug., 1933, P166–P172.

A paper presented at the annual conference, June 7th, 8th, and 9th, 1933, at Harrogate, England. A brief review of the recent work on wool fibre structure. (S)

YOLK IN NEW ZEALAND WOOLS: SOME STUDIES OF THE. II. A STUDY OF YOLK IN THE FLEECE DURING ONE YEAR. William George Sutton. *J. T. I.*, Oct., 1933, P. T341–T350.

The present paper describes an investigation of some aspects of this problem, undertaken with the object of supplying a basis of carefully determined measurements relating to yolk production. It is felt that casual observation cannot supply a true and complete explanation of the function and significance of yolk in the fleece.

This experiment was designed to provide data on the seasonal variations in yolk content of the fleece, and the connection, if any, between yolk and type of wool. This work has now been interrupted, but the results so far obtained may be of interest to other workers.

An experiment is described in which the ether-soluble and water-soluble fractions of the yolk were estimated in the wool of 40 New Zealand Romney sheep at approximately monthly intervals for a year. Seasonal changes in the amount of these two fractions present have been shown. A sudden and marked increase in the quantity of yolk was found at the beginning of winter.

Half the sheep were covered in order to determine the effect of leaching by rain. It was found that the water-soluble fraction was removed to a greater extent than the ether-soluble fraction.

The sheep were chosen to show two types of wool: a fine wool and a stronger wool. The results suggest that there is a tendency for the finer wool to be accompanied by a higher proportion of yolk. (S)

II. YARNS AND FABRICS

CREPING RAYON FABRICS. *Silk J.*, 1933, V. 9, No. 107, P. 28; No. 108, P. 27–28.

The results of experiments in creping all-viscose fabrics with soap solution and caustic solutions indicate that "from most points of view the caustic treatment appears to be unnecessary and merely an extra process with an accompanying extra cost." (Details of experiments on a number of fabrics are given.) The use of NaOH in creping viscose involves extra cost and time and may result in a harsher handle unless the material is stretched during finishing, when it acquires a characteristic soft handle. Viscose becomes somewhat pulpy in NaOH solution and is easily damaged. In matching patterns creped in caustic it is usually necessary to use caustic. (Copied from *Chem. Abs.*, 1933, V. 27, P. 3828.) (W)

FAULTS IN TEXTILE MATERIALS: SOME GENERAL SOURCES OF. Dr. L. L. Lloyd. *J. T. I.*, Aug., 1933, P161–P165.

A brief discussion of the necessity for standardization of processes. A paper presented at the annual conference of the Institute at Harrogate, June 7, 8, 9. (S)

FINISHING TEXTILES: USE OF PECTIN FOR. S. Lyubimov. *Rekonstruktz. Textil. Prom.*, 1932, V. 11, No. 1, P. 47–51; *Chim. et Ind.*, V. 28, P. 667.

Comparative tests with starch and with pectin extracted commercially from exhausted beets showed that: (1) there is practically no difference as regards the strength of the warp, (2) the pectin-treated fibres can be worked as well on Platt looms as on Northrop looms, (3) the pectin treatment is much the simpler, (4) satisfactory results are obtained with pectin even without the addition of auxiliary substances such as glycerol, soap or tallow, generally used in conjunction with starch. The use of 7% pectin is sufficient to dispense entirely with starch, and is much cheaper. (Copied complete from *Chem. Abs.*, 1933, V. 27, P. 3827.) (W)

PREPARING AND FINISHING REPP AND POPLIN FABRICS: REDUCING COSTS AND FAULTS IN THE. G. L. Atkinson. *Tex. Col.*, 1933, V. 55, P. 373–4, 420.

Particular attention is given to the causes and prevention of "watering" or "embossing" of the fabric during processing. (Copied complete from *Chem. Abs.*, 1933, V. 27, P. 3827.) (W)

PRINTING: YUSEN STYLE (TEXTILE). Chas. E. Mullin. *Tex. Col.*, 1932, V. 54, P. 657–9, 708.

Stencil printing of textiles is better developed in Japan than in any other country and is widely used in commercial work on silk, wool, and cotton for kimonos, obi and many other fabrics for domestic use. The process has also been adapted in Shanghai but is only commercially possible where careful and skilful labor is available at a very low rate, except for very high-class fabrics. (Copied complete from *Chem. Abs.*, 1933, V. 27, P. 3826.) (W)

RAYON: INFLUENCE OF THE RATE OF STRETCHING ON THE STRENGTH OF, UNDER CERTAIN CONDITIONS PRESCRIBED BY RECOGNIZED AUTHORITY. Hans Bohringer. (German) *Die Kunstseide*, June, 1933, P. 216–8.

The maximal possible differences in the strength of rayon observed at equal pulling speeds are calculated on the base of a strength-tester working on the pendulum system, and the influence of the elongation at break, the angular deflexion of the weight-lever and the shape of the strength-breaking time-curves of rayon on these differences are represented diagrammatically. The relations so found serve to construct a table from which the maximal differences in strength possible for one and the same pulling speed may be read off for any rayon at the pulling speeds prescribed by "Ral" and "Bisfa," the angular deflexion of the weight lever being taken into account. (S)

RING YARNS: FORCES ON, DURING SPINNING. Lindner and Oertel. *Fils et Tiss.*, 1932, V. 20, P. 242–244, 301–302, 356–358.

A theoretical, mathematical study is made of the forces acting on the ballooning thread on the ring spinning frame, and the practical application of the results in the control of the spinning process is discussed. Motor and spindle speeds and other data are given for the production of various counts on different frames. (Copied complete from *J. T. I.*, Jan., 1933, P. A21.) (S)

SILK AND SEMI-SILK SATINS: PREPARATION OF. K. Pinkas. *Russa,* 1933, V. 8, P. 421–5.

Practical operating directions are given. (Copied complete from *Chem. Abs.,* 1933, V. 27, P. 4085.) (W)

SIZING WARP THREADS ON THE BEAM INSTEAD OF IN SKEINS: ADVANTAGES OF. Stephanus. *Russa,* 1933, V. 8, P. 445, 447.

A brief discussion. (Copied complete from *Chem. Abs.,* 1933, V. 27, P. 4087.) (W)

SOME FAULTS IN FINISHED FABRICS. Percy Bean. *J. T. I.,* Aug., 1933, P194–P203.

A paper presented at the annual conference of the Institute at Harrogate, June 7, 8, 9. The paper describes faults arising at each stage of manufacture from the early processes to the finished cloth for cottons and rayons. Several excellent photographs are included. (S)

SPINNING VALUE OF A COTTON FROM ITS FIBRE-PROPERTIES: PREDICTION OF. A. J. Turner and V. Venkataraman. *Indian Central Cotton Committee Technological Bulletin,* Series B, No. 17, P. 1–48, June, 1933.)

This is Part V of studies on The Foundations of Yarn-Strength and Yarn-Extension at the Indian Central Cotton Committee Technological Laboratory. The report is summarized as follows:

"The present paper deals with the problem of predicting the spinning value of a cotton from its fibre-properties. Previous work is discussed, particularly certain suggested relationships between spinning value and staple length alone or in conjunction with fibre-strength, and also between spinning value and fibre-weight; reference is also made to two other suggested methods of attacking the problem on quite different lines.

"Criteria for judging spinning value are discussed, and the criterion finally adopted is the highest standard warp count, i.e., the highest count that can be spun from the cotton with standard twist to give a specified standard strength.

"The tests at the Technological Laboratory are described for (1) spinning value, and the following fibre-properties—(2) length, (3) weight per inch, (4) ribbon-width, (5) strength, (6) convolutions, (7) rigidity, and (8) clinging-power. The results are given for two series: Series I, in which properties (1) to (7) were determined for 95 samples, and Series II, in which properties (1) to (8) were determined for 45 samples of Indian cottons.

"From these results the attempt has been made to derive prediction formulae for spinning value in terms of the fibre-properties, by means of the method of correlation. This method is briefly explained, together with some of its limitations. It is found that the total correlation coefficient is 0.87 for fibre-length and spinning value, and —0.75 for fibre-weight per inch and spinning value; the partial correlation coefficient of fifth order for the Series I samples is 0.70 for fibre-length and spinning value, and —0.36 for fibre-weight per inch and spinning value. From these results it is clear that the spinning value of Indian cottons is much more accurately assessable from the fibre-length than from the fibre-weight.

"The accuracy of the prediction formulae has been tested by comparing the actual spinning values with those calculated from the fibre-

properties by the aid of the formulae. Using the prediction formula based on fibre-length alone, the difference between actual and predicted spinning values is not greater than 20% in 69% of the cases; the corresponding percentages of cases for other prediction formulae are 53% for fibre-weight alone, 76% for fibre-length and fibre-weight together, with no better result when either fibre-strength or ribbon-width is also included; and only 80% when all six properties are included. As the prediction-formula based on six fibre-properties is thus hardly any more accurate than the prediction-formula based on only the two properties of fibre-length and fibre-weight, it is concluded that the greater labour entailed in determining either the ribbon-width, strength, convolutions, or rigidity, is not worth while except for some special reason.

"Finally, various anomalies between the actual and predicted spinning values are discussed, and a number of reasons advanced to explain them, and to indicate the lines along which future research might profitably be directed.

"Appendix I gives a detailed description of the method of simple and multiple correlation used in obtaining the prediction formulae, and the formulae employed in making the necessary calculations; the method of making these calculations is explained. Many prediction formulae are given, both simple and multiple, and the degree of significance to be attached to the constants in these formulae is also indicated in a number of cases. Two other methods, used as checks, for determining the constants of the prediction formulae, are also briefly described. A note is given on the coefficient of multiple correlation, measuring the correlation between spinning value and all the fibre-properties combined, and having a value for the Series I samples of 0.93, from which it appears that 86.5% of the variation of spinning value is accounted for mathematically by the six fibre-properties, leaving 13.5% to be accounted for otherwise.

"Appendix II gives a description of a short method for revising the total correlation coefficients to include further results as they become available in successive seasons.

"Appendix III consists of tables of experimental results.

"Appendix IV consists of tables showing how actual and predicted values compare.

"Appendix V consists of tables of all the total and partial correlation coefficients calculated in the course of the investigation." (C)

STOCKING FABRICS: PERIODIC VARIATIONS IN HANK PROCESSED YARN, AND THE PATTERNS PRODUCED BY THEM IN. D. A. Clibbens. *J. T. I.* June, 1933, P. T221–232.

It is of great practical importance to determine whether shade irregularity in a dyed stocking is due to a periodic variation, and to measure the length of the period when one is found to be present. It is found in the majority of cases that the irregularities evidenced by these periods prove to be characteristic of the hank structure. The apparatus employed for some yarns at Shirley Institute is described and the paper concludes with a discussion of the relationship of the nature of the pattern and the length of the period. A number of excellent illustrations are reproduced. (S)

TEXTILE MUTOCHROME. C. F. Smith. *Phot. J.*, May, 1933, P. 191–7.

The Mutochrome is a projection lantern device by means of which the colors and shades of a design can be altered by the interchange of color

filters and the operation of iris diaphragms. The application of the instrument to textile design is described. A textile pattern can be projected on a screen from a multiple transparency actually made from a negative photographed with the Mutochrome. A four-element and a seven-element projection lantern are described. A single light source is used with prisms and separate lenses, or else a separate light source for each lens. The instrument is used normally in a darkened room, but can be adapted for use in daylight. A color comparator is described for comparing the colors of pieces of dyed material in artificial daylight illumination with the colors obtained in the Mutochrome image. (Copied complete from *Eastman Kodak Bull.*, Aug., 1933, P. 280.) (S)

THREAD COUNT IN FABRICS: A NEW METHOD FOR. (German.) R. Hunlich. *Die Kunstseide,* March, 1933, P. 106–107.

A brief description of the older form of so-called "Lunometer," forming a diffraction pattern read against a calibrated scale. (S)

THROWN SILK: PROCESSING OF. G. W. Searell. *Am. Silk & Rayon Jnl.*, 1933, V. 52, No. 4, P. 44, 60.

Silk-soaking operations are described. (Copied complete from *Chem. Abs.*, 1933, V. 27, P. 3828.) (W)

TWIST: KINEMATICS OF. H. J. Woods. *J. T. I.* Sept., 1933, P. T317–T332.

An article to be highly recommended to anyone interested in the twist of yarns. The paper emphasises the fact that a practicable theory of twist can only be given in the case of ideal strings. The validity of the results so obtained may be seriously endangered if it is attempted to apply them indiscriminately to imperfect structures such as worsted or woolen yarns. Variability or indefiniteness of yarn diameter, take-up due to change of twist, radial compression of the yarn, and fibre slippage are some of the ways in which such a yarn can depart from the ideal. At best, then, the theory can only apply approximately to such a structure; at worst, the very meaning of the term 'twist' may be in question.

Particular caution is necessary in those cases where the surface fibres of the yarn are to be assumed to lie on generators; if, however, such quantities as "fibre angles" are to be used at all, there is no alternative to making the assumption, and giving the results for what they are worth. (S)

III. CHEMICAL AND OTHER PROCESSING (NOT OTHERWISE CLASSIFIED)

ACETATE RAYON: ON THE SAPONIFICATION OF. H. Bertham. (German.) *Die Kunstseide,* April, 1933, P. 141–3.

Among other things it is pointed out that with certain conditions of saponification the dyestuff forms a surface coating only on the filament. Two pictures of filament cross-sections are given, one with an unsaponified acetate showing complete penetration of the dyestuff and the other with the proper degree of saponification to prevent penetration of the dyestuff. (S)

BENZO FAST COPPER DYESTUFFS. G. Rudolph. *Monatschr. Textil-Ind.*, 1932, V. 47, P. 81–2.

The fastness to light and to washing is increased by treating benzo fast Cu dyestuffs on the fibre with $CuSO_4$. The fastness to chlorine is satisfactory only with benzo fast copper brown 3GL. The following types are on the market: Yellow RL, brown 3GL; red RL, blue GL, violet 3RL and BBL. Instructions for using these dyestuffs are given. (Copied complete from *Chem. Abs.*, 1933, V. 27, P. 3824.) (W)

BLEACHING OF WOOL, COTTON, AND SILK: THE HYDROGEN PEROXIDE. I. E. Weber. *J. T. I.* Aug., 1933, P178–P193.

A paper presented at the annual conference of the Institute at Harrogate, June 7th, 8th, and 9th. (S)

CLOTH MILLING WITH ACIDS. A. Yewdall. *J. T. I.* Aug., 1933, P173–P177.

A paper presented at the annual conference of the Institute at Harrogate, June 7th, 8th, and 9th. (S)

COLOUR: DEFINITION. R. Toussaint. *Chem. Abs.*, 1932, 26, 4751 (from *Bull. Soc. Encour. Ind. Natl.*, 1932, 131, 345–348).

A method of defining colour by relating absorption and wave-length is described. (Copied from *J. T. I.*, Feb., 1933, P. A117.) (S)

DYEING: CONSTANT-TEMPERATURE BATHS FOR. C. E. Mullin. *Tex. Col.*, 1933, V. 55, P. 11–12, 59.

A discussion of different types of constant-temperature baths for use in experimental dyeing, the materials of construction, methods of heating, and heat-conducting liquids used. Constant-temperature baths containing a liquid are generally more satisfactory in commercial laboratories than air baths. Small air baths offer advantages for student use. $NaNO_2$ or $NaNO_3$ solution is suggested as suitable for the wet baths. (Copied complete from *Chem. Abs.*, 1933, V. 27, P. 3825.) (W)

DYEING AND REDYEING SILK HOSIERY. Noel D. White. *Tex. Col.*, 1933, V. 55, P. 371–2, 420.

General. (Copied complete from *Chem. Abs.*, 1933, V. 27, P. 3825.) (W)

DYEING SILK: NOTES ON. C. F. Harleston. *Silk Digest Wkly.*, 1933, V. 24, No. 21, P. 14–18.

Miscellaneous information is given on silk degumming and dyeing. (Copied complete from *Chem. Abs.*, 1933, V. 27, P. 3825.) (W)

DYEING SILK AND RAYON HOSIERY: AVOIDING DEFECTS IN: Geo. H. Clifton. *Tex. Wld.*, 1933, V. 83, P. 1102.

Practical suggestions are given for preventing streaks, spots and chafe marks. (Copied complete from *Chem. Abs.*, 1933, V. 27, P. 3825.) (W)

DYEING WITH INDOCARBON BLACK CL AND CLG. Alexandre Joseph. *Tiba*, 1933, V. 11, P. 345, 347.

These two dyes are carbazole derivatives, and are used in Na_2S baths. The chief difficulties encountered with them are due to their poor soly.

and sensitiveness to Ca and Mg salts; these can be overcome by using Na hyposulfite instead of, or in combination with, Na_2S. The slightly greater cost is more than compensated by the much greater ease of working. (Copied complete from *Chem. Abs.*, 1933, V. 27, P. 3614.) (W)

DYEING WOOL AND COTTON VELVET. George Rice. *Dyer*, 1933, V. 69, P. 560.

Practical suggestions are given on the pretreatment and dyeing of these velvets, the use of which for upholstery and interior decoration is increasing. (Copied complete from *Chem. Abs.*, 1933, V. 27, P. 3825.) (W)

HOSIERY DYEING: AFTER-TREATMENT METHODS IN. R. O. Framlington. *Dyer*, 1933, V. 69, P. 605–6.

The use of diazotizing and developing processes and of metal salts for increasing fastness to light and washing is discussed. Some formulas are given. (Copied complete from *Chem. Abs.*, 1933, V. 27, P. 3826.) (W)

HYDROGEN ION CONCENTRATION: DETERMINATION OF THE, OF HYPOCHLORITE SOLUTIONS WITH THE GLASS ELECTRODE. (*a*) DISSOCIATION CONSTANT OF HYPOCHLOROUS ACID; (*b*) pH VARIATIONS OF HYPOCHLORITE SOLUTIONS DURING THE BLEACHING OF COTTON. George F. Davidson. *J. T. I.*, May, 1933, P. T185–T206.

The present paper describes the application of the glass electrode to the determination of the pH of hypochlorite solutions, and records the results of determinations of the dissociation constant of hypochloric acid, and of investigations on bleach liquors, made with its help. It was shown that when the partially spent bleach liquor is used in making up the solution for the next bleach, the spent liquor exerts a buffer action and reduces the initial pH of the bleach liquor made up with it. When a partially spent liquor is kept, the concentration of available chlorine decreases rather rapidly, and this is shown to be probably due to the oxidation of organic matter derived from the cloth during the bleaching process. This decrease in concentration is accompanied by a decrease in pH. The action of hypochlorite and carbonate buffer systems during bleaching and during storage of partially spent liquors is discussed and an observed rise in pH of completely spent sodium hypochlorite liquors when exposed to the air is explained by loss of carbon dioxide and a consequent readjustment of the carbonate equilibrium in the solution. (S)

MERCERIZED HOSIERY YARNS: EXAMINATION OF. D. A. Clibbens and A. Geake. *J. T. I.*, June, 1933, P. T255–T272.

Following a discussion of the experimental work which includes: deconvolution counts (see *J. T. I.*, T233), shrinkage diagram and redyeing tests. The paper continues with a discussion of the dyeing irregularities caused by chemical attack on the cotton, examination of abrupt changes in shade and the effects of variations in singeing. It has been seen that differences in dyed shade caused by variable gassing are largely eliminated when the yarns are mercerized between gassing and dyeing. The variations in dyed shade caused by ordinary forms of chemical attack of

cotton, such as by process liquors, cannot be corrected by mercerization. This difference in behavior may be due to the fact that the processes of shrinking and stretching to which materials are submitted during mercerization presents them with a fresh surface, so that the chemical modification caused during singeing, and localized in the original surface layer, no longer exerts its effect on the shade of the dyed thread. (S)

IV. Research Methods and Apparatus

Apparatus for Fluorescence Microscopy. *J. Sci. Instr.*, March, 1933, P. 85–8.

Apparatus for microscopic fluorescence analysis made by C. Reichert of Vienna is described. (Copied complete from *Eastman Kodak Abs. Bull.*, May, 1933.) (S)

Color Measuring Instruments: Photo-Electric. H. Neustadt, Jr. *Electronics*, May, 1933, V. 6, P. 128–31.

The methods of measuring color photo-electrically are reviewed. Typical instruments for different types of work are described. (Copied complete from *Eastman Kodak Abs. Bull.*, Aug., 1933, P. 292.) (S)

Load-Extension Recorder: A New Autographic. H. S. Cliff. *J. T. I.*, Oct., 1933, P. T351–T360.

A method is described of obtaining load-extension diagrams of textile yarns and fibres with constant rate of loading throughout each test, and giving diagrams in rectangular co-ordinates. The novel point in the method consists in the application of the load through a spiral spring by the rotation of a torsion-head at constant speed. Two instruments are described: one for threads of strength between 50 and 500 grams, and the other for filaments and hairs of strength below 20 grams. (S)

Oliens in the Textile Industry. M. Kehren. *Fettchem. Umschau*, 1933, V. 40, P. 124–7; cf. *Chem. Abs.*, 1933, V. 27, P. 2816.

The review gives accurate measurements of the Mackey apparatus for testing the fire-hazard of textile oleins, as built by Reynolds & Branson, Leeds, Eng., at the present time. (Copied complete from *Chem. Abs.*, 1933, V. 27, P. 4085.) (W)

Photo-Electric Photometer. P. R. Gleason. *Rev. Sci. Instr.*, 1932, V. 3, P. 556–560.

The sensitive surfaces of two Weston photronic cells have been combined into a single photometer cell such that a simple null method of photometry is available. (Copied complete from *J. T. I.*, Feb., 1933, P. A118.) (S)

Refractive Index of Solids: Investigation on the Determination of the. A. Biot. *Rev. d'optique*, Dec., 1932, P. 481–500.

The underlying principles and apparatus for an immersion method of measuring the index of refraction of a solid body are described. The sample may be regular or irregular. It is immersed in a liquid of index

n. The procedure consists in measuring first the index of the liquid, n, by any classical method, then, by the use of a Fabry and Perot Etalon, in measuring the differential index Δn. The index of the solid, N, is given by the sum of the two terms, $N = n + \Delta n$. (Copied from *Eastman Kodak Abs. Bull.*, July, 1933.) (S)

V. Economics and Miscellany

Naphthalene as a Fumigant for the Immature Stages of Clothes Moths and Carpet Beetles. G. W. Herrick and G. H. Griswold. *J. Econ. Entomol.*, 1933, V. 26, P. 446–51; cf. *Chem. Abs.*, 1932, V. 26, P. 3673.

Two 3-oz. $C_{10}H_8$/5 cu. ft. were toxic to the eggs and larvae of the webbing clothes moth, Tineola bisselliella. Immature larvae of the carpet beetles, Attagenus piceus and Anthrenus verbasci were only partially controlled by this compound. (Copied from *Chem. Abs.*, 1933, V. 27, P. 4087.) (W)

Sewage of the Textile Industry: Principles Involved in Clarifying and Purifying. K. Bochter. *Monatschr. Textil-Ind.*, 1931, V. 46, P. 341–2, 365–6; 1932, V. 47, P. 13–4, 35–6.

Sewage from the bleaching, desizing, boiling, mercerizing, chlorinating and souring processes is neutralized as accurately as possible in an automatic neutralization apparatus and led to an Emscher tank. The sludge must be removed every three to six months. The impurities contained in the sewage from different plants of the dyeing and printing industry are described. (Copied complete from *Chem. Abs.*, 1933, V. 27, P. 4002.) (W)

Book Review

A. S. T. M. Standards on Textile Materials. A. S. T. M. Headquarters, 1315 Spruce St., Philadelphia, Pa. Pp. 164. $1.00.

This publication contains all of the 30 standard and tentative specifications, methods of testing and definitions pertaining to textile materials, which have been issued by the American Society for Testing Materials, through the work of its Committee D–13 on Textile Materials. This is the first compilation of A. S. T. M. standards covering these materials since 1930. Many new standards have been issued since the appearance of the earlier publication so the present edition should be of much convenience to those dealing with textile materials. In addition to the standards, the book includes a psychrometric relative humidity table which combines accuracy and convenience; photomicrographs of common textile fibres; and a proposed potassium-dichromate-oxidation method for the determination of total iron in asbestos textiles. (C.)